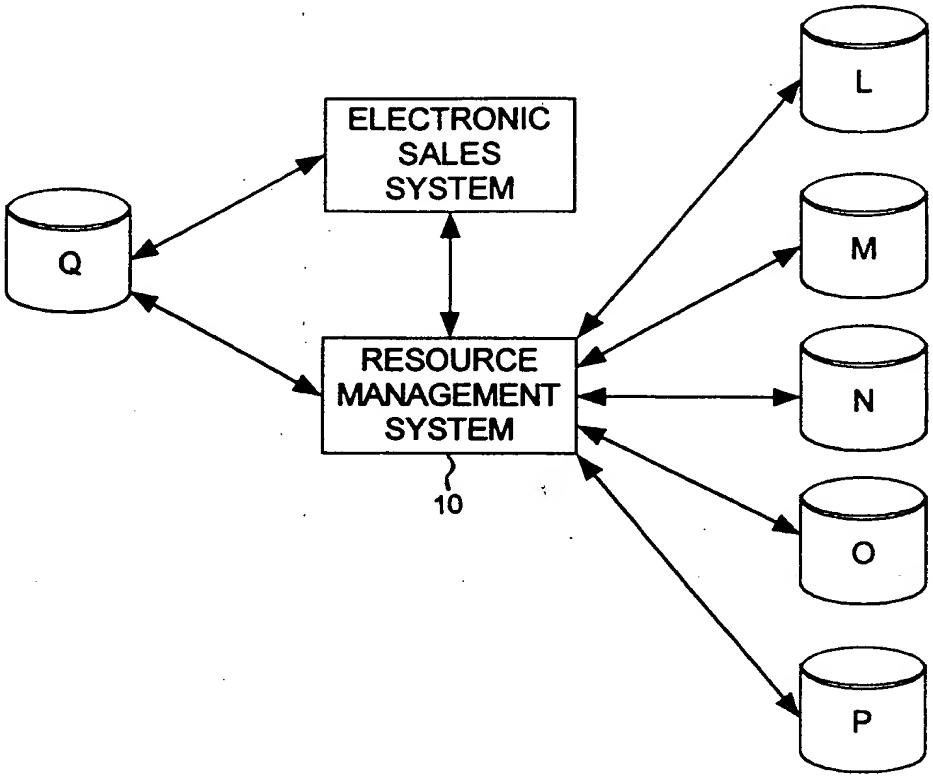

ELECTRONIC SALES SYSTEM
RESOURCE MANAGEMENT SYSTEM
10
Q
L
M
N
O
P

FIG. 1

09/643,976

General Information	Plant Name	
	Address	
	City	
	State	
	Zip	
	Phone	
	Fax	
	Contact	
	User Size	
	Industry	
Plant Profile	# of pumps/mixers	
	# of seals per pump	
	# of sealed stuffing boxes in Plant	
	% of pumps sealed	
	% of pumps packed	
	Average seal list price	
	% of seals purchased new annually	
	% of seals purchased as factory repair or rebuild kits annually	
	Factory repair/rebuild price as a % of new seal price	
	% of population requiring solid shaft seals	
	Avg. shaft seal size (in inches) in plant	
	# of Pumps, Mixers, Flushed With Seal Water into packed boxes	
	# of Pumps, Mixers, Stuffing Boxes which are flushed with seal water which require evaporation later on. (Ex. Dilute black liquor pumps in pulp & paper industry.	
Cost Information	Proposed Estimated Annual Seal Expenditure. (Revised Plant Estimate New Seals Only)	
	Average Seal List Price Per Seal	
	Average Cost of 1 hour of Labor With All Benefits Included	
	Average Cost of Shaft or Sleeve Damage	
	Avg. Cost for Bearings, Lip Seals, Gaskets, Etc.	
	Additional Cost of Seasoned Trained Professional vs. Novice Per Hour	
	Cost Per Seal Per Year For Housecleaning (Please Estimate)	
	Annual Cost Of Production Dowtime	
	Actual/Estimated Plant Cost for One Failure	
	Cost of Electricity Per Kilowatt Hours	
	Average Cost Of Packing Set	
	Cost of Seal Flush Water Per 1,000 Gallons	
	Evaporation Cost of 1 Gallon of Water	
	Cost of 1 million BTUs	

FIG. 2A

	Ex. If Plant Seal Water Costs Are .15/1000 gallons and effluent treatment costs are .75/1000 gallons .75/.15 = 5	
	Avg. Cost of Product/Gal. (Please keep in mind that fluids like condensate have a cost and should be included)	
	Avg. Labor Cost of Unscheduled Repairs & Maintenance & Operations Combined)	
	Production Cost of Machine Time Per Hour (Ex. Paper Machine)	
	Cost of Housekeeping Service/Hours	
	Split & Unsplit Average Price For Single W/Flow Meter or Double Seal Per Inch (Shaft Sleeve Dia.)	

FIG. 2B

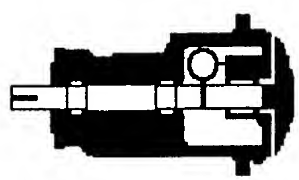
		% Plant Seal Population	# of Seals In Plant 34	Decrease In Seal Life Due To Seal Design Deficiencies Which Increase LCC (Life Cycle Cost)																						Est. % Decrease in Seal Life For Model Selected	Seal Price% Relative To Delta Cart. Seal
				Inferior Rotary Design (?)		Inferior Unbalanced Design (?)		Inferior Double Seal Design (?)		Inferior Face Material (?)		Inferior Tight Clearance Design (?)		Unreliable Installation (?)		Spring Failure When Immersed in process fluid (?)		Metal Bellows Failure When Immersed in process fluid (?)		Rotary Face Under Tension (?)		Inferior Gland Flush Design (?)		Other Deficiencies From F&B Chart			
				Ind. Est. % 36	Plt Est. % 38	Ind. Est. %	Plt Est. %	Ind. Est. %	Plt Est. %	Ind. Est. %	Plt Est. %	Ind. Est. %	Plt Est. %	Ind. Est. %	Plt Est. %	Ind. Est. %	Plt Est. %	Ind. Est. %	Plt Est. %	Ind. Est. %	Plt Est. %	Ind. Est. %	Plt Est. %	Ind. Est. %	Plt Est. %		
	3000 32																										
Cart. Sgle Seals	T-9;9t;9 30	100	200	30		25				50		200		25		100										455	49.49%
Cart. Dble Seals																											
Split Seals																											
Cart. Spec. Seals																											
Comp. Seals Sgle & Dble																											
Other Seals																											
Plant Seal Population		100	200	Average Decrease in Seal Life For The Entire Plant Seal Population Due to Existing Design Deficiencies:%																						455	49.49%

FIG. 3

4A
4B

This is one example of one item on a check list

	The supplier of product responsibility identifier
This checklist enables front line workers to identify existing conditions in the field which drive all decisions regarding repair/rebuild and purchase of parts, etc. The equipment checklists act as the real world indicator to arrive at scientific precise life expectancy which up until now was only obtained in labratory conditions.	This section when completed in the field automatically feeds information back to equipment mfgs holding them responsible for life of the product and all costs associated with it. This may become obsolete over time due to the fact that mfgs will not be able to suply these specificatins in the future as customers will demand real world solutions.

Knowledge Based Pictorial/Checklist						Pump Mfg. Specifications	Seal Mfg. Specifications		
Verification Method					When To Check	What to Check Against	What to Check Against	Accountable Party Signoff	Specifications Good/No Good
Use a dial indicator to verify perpendicularity between the stuffing box face and the shaft O.D.					5 Performed in shop before equipment is disassembled.	Manufacturers Specifications: Stuffing Box Face Perpendicularity - Recommended .007" TIR max.	Manufacturers Specifications: Stuffing Box Face Perpendicularity - Recommended .003" TIR max.	Example: Seal Mfg assumes responsibility for performance	No Good Value: .017
0-.002	.002 - .005	.005-.010	.010 - .020		.020 - .030				

Actual		

FIG. 4A

			912 days	386 days	196 days	121 days	45 days			Mfg is held accountable	Recorded from drop down menus
						*					
General Design	Cartridg & Component	Single Design									
		Double Design							* = the recorded value that applies to your organization.		
		Cartridge Design									
		Component Design									
		Stationary Design	0	0	0	0	0				
		Rotary Design	25	50	75	100	200				
		Balanced Design									
		Unbalanced Design									
		Tandem Design									
		Back to Back Design									
		Internally Mounted Design									
		Externally Mounted design									
		Large Clearance Design									
		Tight Clearance Designs									
		Dbl. seal with pumping ring design									
		Double seal without pumping ring design									

40

FIG. 4B

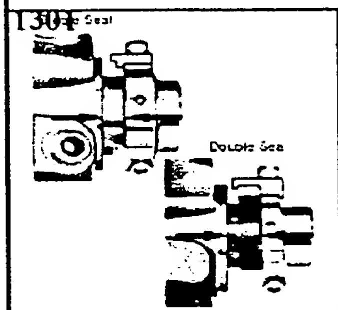
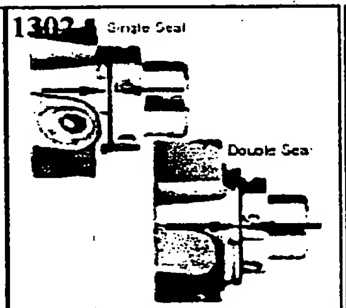
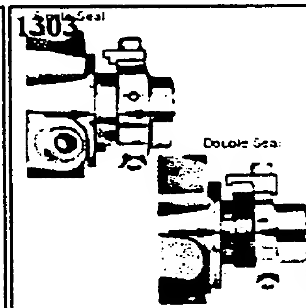
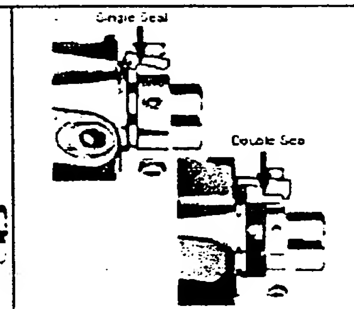
Seal Failure Analysis Inspection Form

To perform a seal failure analysis, you have been provided photos for all seal types typically found in service. Simply click on the photo(s) that best identifies the conditions of the seal you are analyzing.

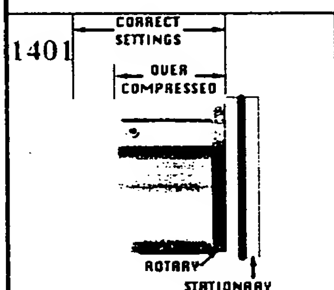
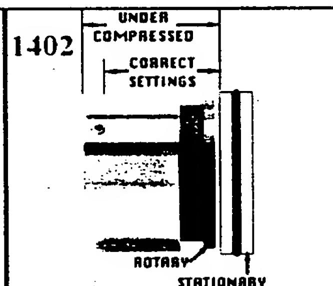
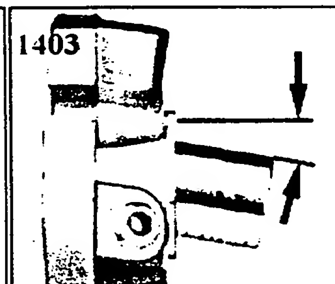
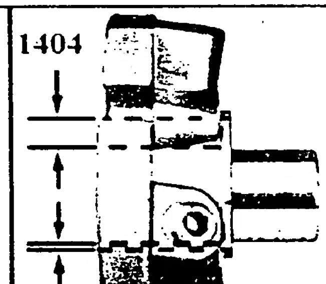
After all applicable pictures have been selected, click on the "When Failure Analysis Is Complete ~~Click~~ Here To Go To Seal Failure Analysis Report and Add Additional Comments/Notes If Required." button to continue.

If safety issues allow, inspect parts before and after cleaning as photos require.

Cartridge Seal: Seal Settings

1301 	1302 	1303 	
Incorrect settings due to seal being over compressed: Gap between lock collar and gland is too large. (Axial Direction)	Incorrect settings due to seal being under compressed: Gap between lock collar and gland is too small. (Axial Direction)	Incorrect settings due to gland face to shaft/sleeve not being perpendicular.	Incorrect settings due to shaft/sleeve being off centered to gland. Radial off-centering (up, down, left or right) between shaft/sleeve and gland ID

Component Seal: Seal Setting

1401 	1402 	1403 	1404 
Incorrect setting due to seal being over compressed: Setting of rotary unit is wrong causing the seal to be over compressed.	Incorrect setting due to seal being under compressed: Setting of rotary unit is wrong causing the seal to be under compressed.	Incorrect setting due to gland face to shaft/sleeve not being perpendicular.	Incorrect setting due to gland not being centered to shaft.

Cartridge Seal: Environment

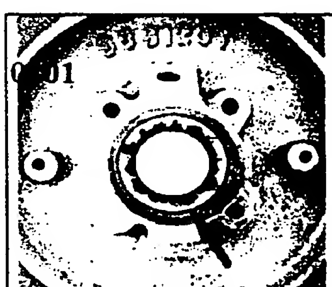
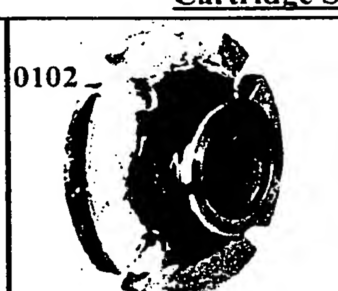
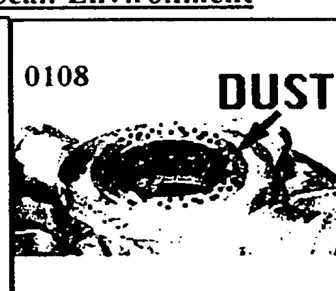
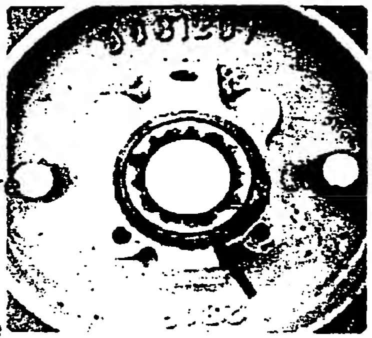
0101 	0102 	0108 	0110 
Seal area packed with product	Seal gland packed with product	Carbon dust visible on front or ID of gland.	Crystalization/Solidification of product on atmospheric side of gland

FIG. 5A

Click here to identify the most probable casue of failure



Seal area packed with product

50

Reason	Cause	Verification	Corrective Action
Thermal sensitive fluids are not maintained in liquid state in the seal area, causing it to build up on seal components	Cartridge: Seal chamber temperature is raised or lowered beyond the solidification point of the process fluid.	Cartridge: Verify the actual solidification point of the process fluid and the temperature maintained in the stuffing box seal area.	Cartridge: Review materials of construction recommendations. Review API plan and heating and cooling plan recommendations to control seal environment.
Undissolved solids pack up in the seal area and on the seal components	Cartridge: Heavy concentration of undissolved solids are allowed to accumulate in the seal area.	Cartridge: Verify concentration of the % of solids present in the process stream.	Cartridge: Review materials of construction recommendations. Review API plan and heating and cooling plan recommendations to control seal environment.
Undissolved fibrous solids pack up in the seal area on the seal components	Cartridge: Heavy concentration of fibrous solids are allowed to accumulate in the back cover/stuffing box.	Cartridge: Verify concentration of the % of solids present in the process stream.	Cartridge: Review materials of construction recommendations. Review API plan and heating and cooling plan recommendations to control seal environment.
Thermal cycling resulting in premature seal failure.	Inferior Casing Design For Temperature Control	Please confirm that an inferior casing design for temperature control is being used.	Replace with a superior casing design for temperature control.
Thermal sensitive fluids are not maintain d in liquid state in the seal area, causing it to build up on seal components	Component: Seal chamber temperature is raised or lowered beyond the solidification point of the process fluid.	Component: Verify the actual solidification point of the process fluid and the temperature maintained in the stuffing box seal area.	Component: Review materials of construction recommendations. Review API plan and heating and cooling plan recommendations to control seal environment.

FIG. 5B

6A
6B
6C

Skill Level Available 62

	Specify														
	Analyze Constraints			Gather Information To Make Purchasing Decision			Assess Information			Perform Analysis			Decide on Repair/ Rebuild of product or service		
	Work Force Average Skill Level	Individual Skill Level		Work Force Average Skill Level	Individual Skill Level		Work Force Average Skill Level	Individual Skill Level		Work Force Average Skill Level	Individual Skill Level		Work Force Average Skill Level	Individual Skill Level	
		John	Mary		John	Mary		John	Mary		John	Mary		John	Mary
	5												6	7	5
Product/Service Skill Level Rating Required (Example: A Component Mechanical Seal)															
Single Design															
Double Design															
Cartridge Design															
Component Design															
Stationary Design															

FIG. 6A

60 General Design		Rotary Design
		Balanced Design
		Unbalanced Design
		Tandem Design
		Back to Back Design
		Internally Mounted Design
		Externally Mounted design
	Cartridge & Component	Large Clearance Design
		Tight Clearance Designs
		Double seal with pumping ring design
		Double seal without pumping ring design
		High Balance Ratio
		Low Balance Ratio
		Spring Loaded Design
		Metal Bellows Design
		Light Spring Load Per Square Inch
		High Spring Load Per Square Inch
		Wide Face Width
		Narrow Face Width
	Cartridge & Component Design	Single Seal with Large Dual Tangential Flush Holes
		Single Seal with Small Straight Drill Holes Or No Flush Holes

FIG. 6B

		onent	Double seal with two flush holes on same surface																
			Double seal with two flush holes 180 degrees apart																
Glands	Materials of construction	Cartridge & Component	316SS Metallurgy																
			Alloy 20 Metallurgy																
			Hastelloy C Metallurgy																
			Titanium Metallurgy																
	Repair & Rebuilding Procedures	Cartridge & Component	Practice of using OEM certified glands in repair/rebuild																
			Practice of not using OEM certified glands in repair/rebuild														30%	20 %	40 %

FIG. 6C

7A	7C	7E
7B	7D	7F

Seal Type
C1 & C2 require double seal

					Single	Double	316 SS
Process Fluid 76			Acetone; Tem <210 F	Operating Conditions System Recommendations		Double	A
Seal Inf rmation 70				T-9;9t;9			
				Seal Attributes			
			Seal Mfg/Model				
Glands 71	Materials of construction	Cartridge & Component	316SS Metallurgy				
			Alloy 20 Metallurgy				
			Hastelloy C Metallurgy				
			Titanium Metallurgy				
Sleeves or Barrels 72	Materials of construction	Cartridge & Component	316SS Metallurgy				
			Alloy 20 Metallurgy				
			Hastelloy C Metallurgy				
			Titanium Metallurgy				
			Practice of using OEM certified faces in repair/rebuild				
			Practice of not using OEM certified faces in repair/rebuild				
			One Piece Carbon Soft Face Material Under Compression				
			One Piece Carbon Soft Face Material Under Tension				
			Two Piece Carbon Soft Face Material Under Compression				
			Two Piece Carbon Soft Face Material Under Tension				
			Practice of replacing soft seal faces on cartridge and component seals.				
			Practice of reusing relapped soft seal faces on cartridge and component seals.				

FIG. 7A

I/B Rotary Face Materials of Construction	Cartridge & Component	One Piece Ceramic Hard Face Material Under Compression				
		One Piece Thin Walled Ceramic Hard Face Material Under Tension				
		Two Piece Ceramic Hard Face Material Under Compression				
		Two Piece Ceramic Hard Face Material Under Tension				
		One Piece Plated TC Hard Face Material Under Compression				
		One Piece Plated TC Hard Face Material Under Tension				
		Two Piece Plated TC Hard Face Material Under Compression				
		Two Piece Plated TC Hard Face Material Under Tension				
		One Piece Nick. Bonded TC Hard Face Material Under Compression				
		One Piece Nick. Bonded TC Hard Face Material Under Tension				
		Two Piece Nick. Bonded TC Hard Face Material Under Compression				
		Two Piece Nick. Bonded TC Hard Face Material Under Tension				
		One Piece Rxn Bond SC Hard Face Material Under Compression				
		One Piece Thin Walled Rxn Bond SC Hard Face Material Under Tension				
		Two Piece Rxn Bond SC Hard Face Material Under Compression				
		Two Piece Rxn Bond SC Hard Face Material Under Tension				
		One Piece Alpha SC Hard Face Material Under Compression				
		One Piece Thin Walled Alpha SC Hard Face Material Under Tension	Yes			
		Two Piece Alpha SC Hard Face Material Under Compression				
		Two Piece Alpha SC Hard Face Material Under Tension				
		One Piece Chrome Oxide Hard Face Material Under Compression				
		One Piece Chrome Oxide Hard Face Material Under Tension				
		Two Piece Chrome Oxide Hard Face Material Under Compression				
		Two Piece Chrome Oxide Hard Face Material Under Tension				
		Practice of replacing hard seal faces on cartridge and component seals.				
		Practice of reusing relapped hard seal faces on cartridge and component seals.				
		Practice of replacing seal faces with corrosion/pitting on cartridge and component seals.				
		Practice of reusing seal faces with corrosion/pitting on cartridge and component seals.				

FIG. 7B

Metalurgy			Faces							Elastomers															
		73					74							75			Viscosity triggers If >								
Alloy 20	Hast C	Titanium	Carbon	Alpha Sintered SC	Rxn. Bonded SC	Nickel Bonded TC	Plated TC	Ceramic	Chrome Oxide	Viton	EPR	Teflon	Aflas	Kalrez	Chemraz	Graphoil	Product Ha								
																	The increase or decrease in resource life		The increase or decrease in resource						
A	A		A	A	A	A		A		N	A	A	N	A	A	A									
																	MTBF		"H"						
																	Estimated Product Life In Days		Labor Cost, etc.						Cos Res
																	Est. Life	Best in Class	Specify	Install	Operate	Maintain	Dispose	Etc.	Cost of M

FIG. 7C

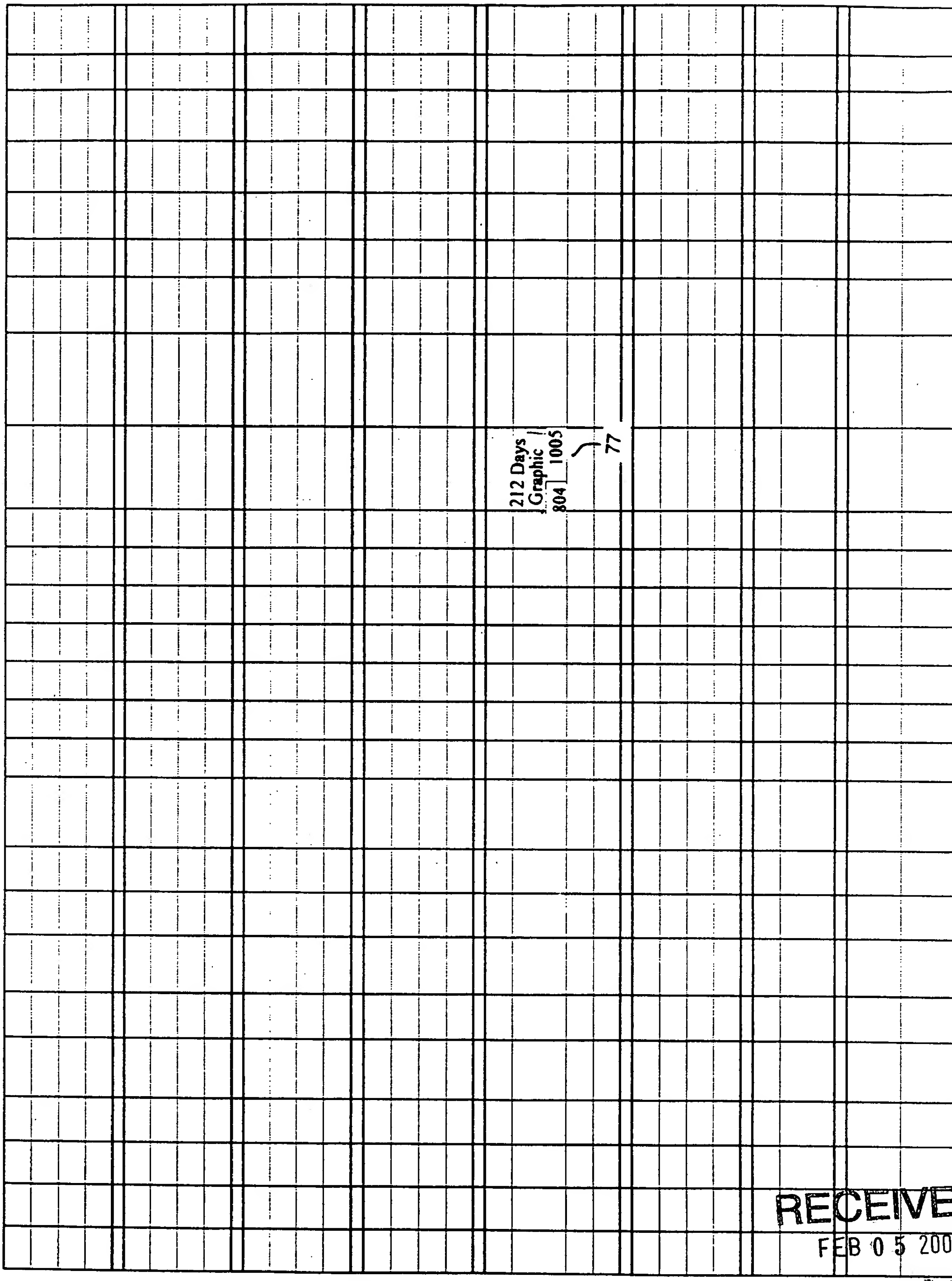


FIG. 7D

a 2 piece head. Predetermined in the process fluid file. 15001 - Consult factory for viscosity issues											
is Viscosity > 15000											Product Has Viscosity < 15000
15500											
life increases or decreases the H, M, O resource costs as a result of all decisions when buying, using, or selling a resource.											
'M"	"O"										
t of M ources	Cost of Item		Utilities				Safety		Environmental		
Etc.	Cost of Item	Etc.	Energy/ Electirc	Water	Sewage	Etc.	Safety	Etc.	Environmental	Etc.	

FIG. 7E

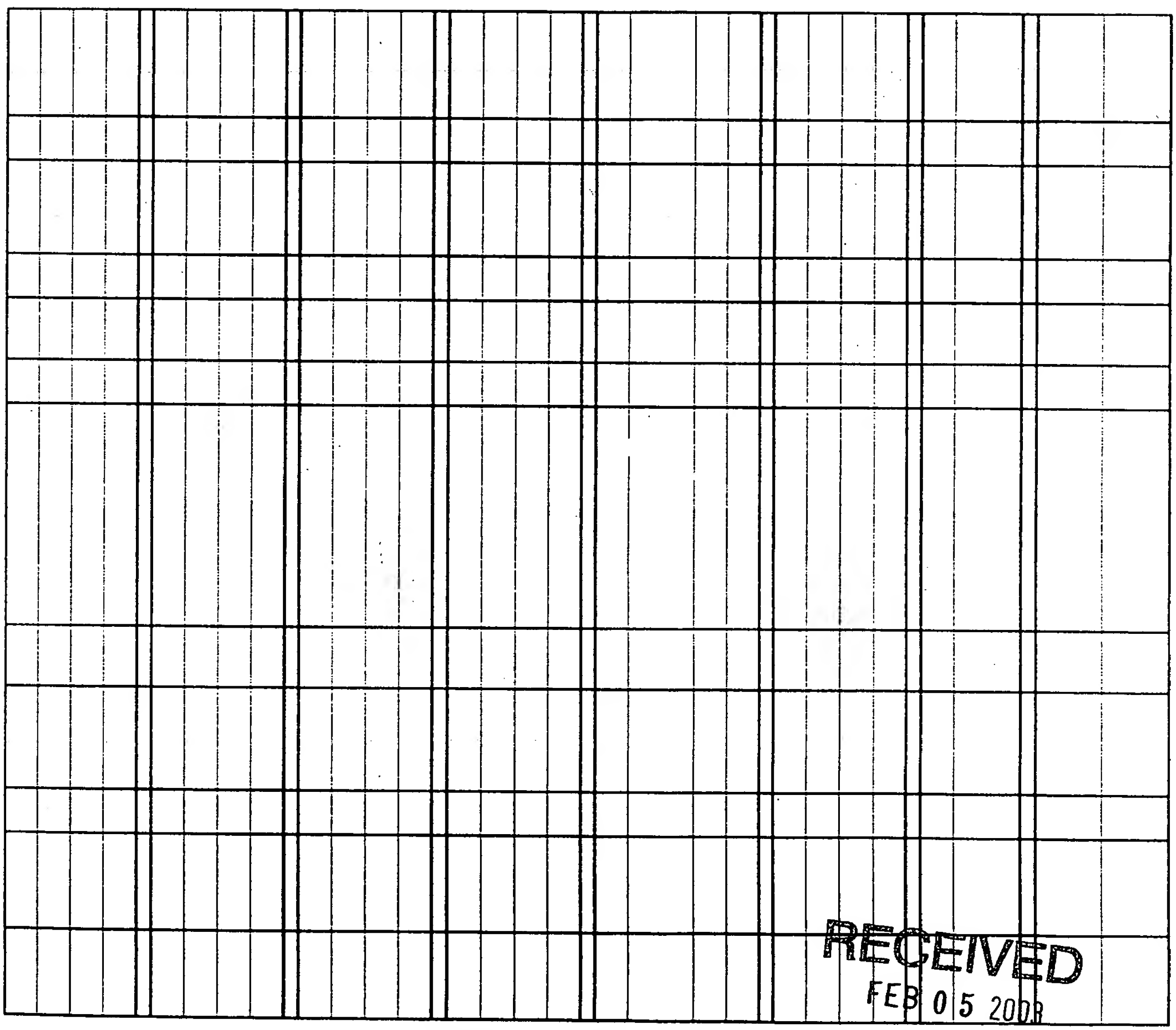


FIG. 7F

Seal:		xxxxxxxx
		Product/Service Skill Level Rating Required
Seal Itself	Specify	7.5
	Purchase	5
	Install with generic installation instructions	10
	Install with engineered installation instructions	5
	Operate with generic operating instructions	5
	Operate with engineered operating instructions	2.5
	Disposal	2.5
	Sell	2.5
Repair / Rebuild of Seal	Specify	2.5
	Purchase	2.5
	Repair	7.5
	Disposal	5
	Sell	2.5
API Plans for Seal	Specify	7.5
	Purchase	2.5
	Install with generic installation instructions	7.5
	Install with engineered installation instructions	2.5
	Operate with generic operating instructions	5
	Operate with engineered operating instructions	2.5
	Disposal	7.5
	Sell	2.5

80

82

84

FIG. 8

07/640,176

		3196 (Pump)
Seal	AV3000175A (Seal)	Seal fits with no modifications
	AV3200175EA (Seal)	Seal fits with no modifications
	XXXXX 5610	Special gland modifications required
	XXXXX Type 9	Special sleeve modificatins required
	XXXXX 155	
	XXXXX 123	

These results come from the CA & SS from ESP

FIG. 9

		Process Fluid
		Acetone; Tem <210 F
		System Recommendations
Recommended Seal Type	Single	
	Double	Double
Metalurgy	316 SS	A
	Alloy 20	A
	Hast C	A
	Titanium	N
	Carbon	A
	Alpha Sintered SC	A
	Rxn. Bonded SC	A
Faces	Nickel Bonded TC	A
	Plated TC	N
	Ceramic	A
	Chrome Oxide	N
Elastomers	Viton	N
	EPR	A
	Teflon	A
	Aflas	N
	Kalrez	A
	Chemraz	A
	Graphoil	A
	C31- Mfg. Recommends The Use of A Model that supports an option two piece stationary head	No
	Pumping Feature Required	Yes
	Quench & Drain Required	No

FIG. 10

1102 1100

Skill Level Available	Specify	Analyze Constraints	Work Force Average Skill Level		5
			Individual Skill Level	John	7
				Mary	3
		Gather Information To Make Purchasing Decision	Work Force Average Skill Level		5
			Individual Skill Level	John	7
				Mary	3
		Assess Information	Work Force Average Skill Level		5
			Individual Skill Level	John	7
				Mary	3
		Perform Analysis	Work Force Average Skill Level		5
			Individual Skill Level	John	7
				Mary	3
		Decide on Repair/ Rebuild of product or service	Work Force Average Skill Level		5
			Individual Skill Level	John	7
				Mary	3
		Assess Safety Impact	Work Force Average Skill Level		5
			Individual Skill Level	John	7
				Mary	3
		Decide Safety Requirements	Work Force Average Skill Level		5
			Individual Skill Level	John	7
				Mary	3
		Assess Environmental Impact	Work Force Average Skill Level		5
			Individual Skill Level	John	7
				Mary	3
		Decide Environmental Requirements	Work Force Average Skill Level		5
			Individual Skill Level	John	7
				Mary	3
		Assess QC Requirements	Work Force Average Skill Level		5
			Individual Skill Level	John	7
				Mary	3
		Decide QC Requirements	Work Force Average Skill Level		5
			Individual Skill Level	John	7
				Mary	3
		Assess Mfgs. Capabilities	Work Force Average Skill Level		5
			Individual Skill Level	John	7
				Mary	3
		Decide on Mfg.	Work Force Average Skill Level		5
			Individual Skill Level	John	7
				Mary	3
		Decide on Specifications	Work Force Average Skill Level		5
			Individual Skill Level	John	7
				Mary	3
	Purchase	Decide and Prepare RFQ	Work Force Average Skill Level		7
			Individual Skill Level	Bill	10
				Ed	4
		Receive RFQ Responses and Analyze	Work Force Average Skill Level		7
			Individual Skill Level	Bill	10
				Ed	4

FIG. 11A

		Make Decision To Buy Product	Work Force Average Skill Level		7
			Individual Skill Level	Bill	10
				Ed	4
	Install	Assess equipment condition	Work Force Average Skill Level		6
			Individual Skill Level	Jim	9
				Ray	3
		Install Product	Work Force Average Skill Level		6
			Individual Skill Level	Jim	9
				Ray	3
	Operation	Startup of Equipment	Work Force Average Skill Level		8
			Individual Skill Level	Mike	10
				Jeff	6
		Operation of Equipment	Work Force Average Skill Level		8
			Individual Skill Level	Mike	10
				Jeff	6
	Disposal	Disposal of Equipment	Work Force Average Skill Level		4
			Individual Skill Level	Wayne	6
				Terry	2
	Sell	Decide on Sale	Work Force Average Skill Level		4
			Individual Skill Level	Sue	3
				Lori	5

FIG. 11B

T-9;9t;9

				Seal Attributes
General Design 1200		Cartridge & Component	Single Design	Single
			Double Design	
			Cartridge Design	Cartridge
			Component Design	
			Stationary Design	
			Rotary Design	Yes
			Balanced Design	
			Unbalanced Design	Yes
			Tandem Design	
			Back to Back Design	
			Internally Mounted Design	
			Externally Mounted design	Yes
			Large Clearance Design	
			Tight Clearance Designs	Yes
			Double seal with pumping ring design	Yes
			Double seal without pumping ring design	
			High Balance Ratio	
			Low Balance Ratio	Yes
			Spring Loaded Design	
			Metal Bellows Design	
			Light Spring Load Per Square Inch	
			High Spring Load Per Square Inch	
			Wide Face Width	
			Narrow Face Width	
	Design	Cartridge & Component	Single Seal with Large Dual Tangential Flush Holes	
			Single Seal with Small Straight Drill Holes Or No Flush Holes	Yes
			Double seal with two flush holes on same surface	
			Double seal with two flush holes 180 degrees apart	
1204	Materials of construction	Cartridge & Component	316SS Metallurgy	Yes
			Alloy 20 Metallurgy	
			Hastelloy C Metallurgy	
			Titanium Metallurgy	
		Cartridge & Component	Practice of using OEM certified glands in repair/rebuild	
			Practice of not using OEM certified glands in repair/rebuild	
			Practice of replacing glands on cartridge seals with pitted surfaces	

FIG. 12A

Glands	Repair & Rebuilding Procedures 1202	Cartridge	Practice of reusing glands on cartridge seals with pitted surfaces	
			Practice of replacing gland on cartridge seals with damaged (elongated) spring holes	
			Practice of reusing gland on cartridge seals with damaged (elongated) spring holes	
			Practice of replacing cartridge seals with worn anti-rotation lugs, pins, tabs, (tangs) in gland	
			Practice of reusing cartridge seals with worn anti-rotation lugs, pins, tabs, (tangs) in gland	
			Practice of replacing cartridge seals with missing anti-rotation lugs, pins, tabs, (tangs) in gland	
			Practice of reusing cartridge seals with missing anti-rotation lugs, pins, tabs, (tangs) in gland	
		Component	Practice of replacing glands on component seals with pitted surfaces	
			Practice of reusing glands on component seals with pitted surfaces	
			Practice of replacing gland on component seals with damaged (elongated) spring holes	
			Practice of reusing gland on component seals with damaged (elongated) spring holes	
			Practice of replacing component seals with worn anti-rotation lugs, pins, tabs, (tangs) in gland	
			Practice of reusing component seals with worn anti-rotation lugs, pins, tabs, (tangs) in gland	
			Practice of replacing component seals with missing anti-rotation lugs, pins, tabs, (tangs) in gland	
			Practice of reusing component seals with missing anti-rotation lugs, pins, tabs, (tangs) in gland	
	Materials of construction	Cartridge & Component	316SS Metallurgy	Yes
			Alloy 20 Metallurgy	
			Hastelloy C Metallurgy	
			Titanium Metallurgy	
			Practice of using OEM certified sleeves in repair/rebuild	
			Practice of not using OEM certified sleeves in repair/rebuild	
			Practice of replacing cartridge seals with worn drive lugs, pins, tabs, (tangs) in sleeve	
			Practice of reusing cartridge seals with worn drive lugs, pins, tabs, (tangs) in sleeve	
			Practice of replacing cartridge seals with missing drive lugs, pins, tabs, (tangs) in sleeve	
			Practice of reusing cartridge seals with missing drive lugs, pins, tabs, (tangs) in sleeve	

FIG. 12B

Sleeves or Barrels	Repair & Rebuilding Procedures	Cartridge	Practice of replacing sleeves on cartridge seals with damaged (elongated) spring holes	
			Practice of reusing sleeves on cartridge seals with damaged (elongated) spring holes	
			Practice of replacing cartridge seals with worn drive lugs, pins, tabs, (tangs) on rotary unit set screwed to sleeve	
			Practice of reusing cartridge seals with worn drive lugs, pins, tabs, (tangs) on rotary unit set screwed to sleeve	
			Practice of replacing cartridge seals with missing drive lugs, pins, tabs, (tangs) on rotary unit set screwed to sleeve	
			Practice of reusing cartridge seals with missing drive lugs, pins, tabs, (tangs) on rotary unit set screwed to sleeve	
			Practice of replacing sleeves on cartridge seals with pitted surfaces	
			Practice of reusing sleeves on cartridge seals with pitted surfaces	
			Practice of replacing damaged (fretted) sleeves on cartridge seals	
			Practice of reusing damaged (fretted) sleeves on cartridge seals	
		Component	Practice of using OEM certified barrels in repair/rebuild	
			Practice of not using OEM certified barrels in repair/rebuild	
			Practice of replacing component seals with worn drive lugs, pins, tabs, (tangs) in rotary unit	
			Practice of reusing component seals with worn drive lugs, pins, tabs, (tangs) in rotary unit	
			Practice of replacing component seals with missing drive lugs, pins, tabs, (tangs) in rotary unit	
			Practice of reusing component seals with missing drive lugs, pins, tabs, (tangs) in rotary unit	
			Practice of replacing rotary units on component seals with damaged (elongated) spring holes	
			Practice of reusing rotary units on component seals with damaged (elongated) spring holes	
			Practice of replacing barrels on component seals with pitted surfaces	
			Practice of reusing barrels on component seals with pitted surfaces	
			Practice of replacing damaged (fretted) rotary sleeves or barrels on component seals.	
			Practice of reusing damaged (fretted) rotary sleeves or barrels on component seals.	

FIG. 12C

Face Holders	Materials of construction	Cartridge & Component	316SS Metallurgy	
			Alloy 20 Metallurgy	
			Hastelloy C Metallurgy	
			Titanium Metallurgy	
	Repair & Rebuilding Procedures	Cartridge & Component	Practice of using OEM certified face holders in repair/rebuild	
			Practice of not using OEM certified face holders in repair/rebuild	
		Cartridge	Practice of replacing face holders on cartridge seals with pitted surfaces	
			Practice of reusing face holders on cartridge seals with pitted surfaces	
			Practice of replacing face holders on cartridge seals with worn drive/anti-rotation slots	
			Practice of reusing face holders on cartridge seals with worn drive/anti-rotation slots	
		Component	Practice of replacing face holders on component seals with pitted surfaces	
			Practice of reusing face holders on component seals with pitted surfaces	
			Practice of replacing face holders on component seals with worn drive/anti-rotation slots	
			Practice of reusing face holders on component seals with worn drive/anti-rotation slots	
Lock Collars	Materials of construction	Cartridge & Component	316SS Metallurgy	
			Alloy 20 Metallurgy	
			Hastelloy C Metallurgy	
			Titanium Metallurgy	
	Repair & Rebuilding Procedures	Cartridge & Component	Practice of using OEM certified lock collars in repair/rebuild	
			Practice of not using OEM certified lock collars in repair/rebuild	
		Cartridge	Practice of replacing cartridge seals with damaged/oversized set screw holes on lock collars.	
			Practice of reusing cartridge seals with damaged/oversized set screw holes on lock collars.	
			Practice of replacing cartridge seals with worn drive lugs, pins, tabs, (tangs) on lock collar	
			Practice of reusing cartridge seals with worn drive lugs, pins, tabs, (tangs) on lock collar	
			Practice of replacing cartridge seals with missing drive lugs, pins, tabs, (tangs) on lock collar	
			Practice of reusing cartridge seals with missing drive lugs, pins, tabs, (tangs) on lock collar	

FIG. 12D

			Practice of replacing lock collars on cartridge seals with pitted surfaces	
			Practice of reusing lock collars on cartridge seals with pitted surfaces	
		Component	Practice of replacing component seals with damaged/oversized set screw holes.	
			Practice of reusing component seals with damaged/oversized set screw holes.	
	I/B Stationary Face Materials of Construction	Cartridge & Component	Practice of using OEM certified faces in repair/rebuild	
			Practice of not using OEM certified faces in repair/rebuild	
			One Piece Carbon Soft Face Material Under Compression	
			One Piece Carbon Soft Face Material Under Tension	
			Two Piece Carbon Soft Face Material Under Compression	
			Two Piece Carbon Soft Face Material Under Tension	
			Practice of replacing soft seal faces on cartridge and component seals.	
			Practice of reusing relapped soft seal faces on cartridge and component seals.	
			One Piece Ceramic Hard Face Material Under Compression	
			One Piece Ceramic Hard Face Material Under Tension	
			Two Piece Ceramic Hard Face Material Under Compression	
			Two Piece Ceramic Hard Face Material Under Tension	
			One Piece Plated TC Hard Face Material Under Compression	
			One Piece Plated TC Hard Face Material Under Tension	
			Two Piece Plated TC Hard Face Material Under Compression	
			Two Piece Plated TC Hard Face Material Under Tension	
			One Piece Nick. Bonded TC Hard Face Material Under Compression	
			One Piece Nick. Bonded TC Hard Face Material Under Tension	
			Two Piece Nick. Bonded TC Hard Face Material Under Compression	
			Two Piece Nick. Bonded TC Hard Face Material Under Tension	
			One Piece Rxn Bond SC Hard Face Material Under Compression	
			One Piece Rxn Bond SC Hard Face Material Under Tension	
			Two Piece Rxn Bond SC Hard Face Material Under Compression	

FIG. 12E

	Two Piece Rxn Bond SC Hard Face Material Under Tension	
	One Piece Alpha SC Hard Face Material Under Compression	
	One Piece Alpha SC Hard Face Material Under Tension	
	Two Piece Alpha SC Hard Face Material Under Compression	
	Two Piece Alpha SC Hard Face Material Under Tension	
	One Piece Chrome Oxide Hard Face Material Under Compression	
	One Piece Chrome Oxide Hard Face Material Under Tension	
	Two Piece Chrome Oxide Hard Face Material Under Compression	
	Two Piece Chrome Oxide Hard Face Material Under Tension	
	Practice of replacing hard seal faces on cartridge and component seals.	
	Practice of reusing relapped hard seal faces on cartridge and component seals.	
	Practice of replacing seal faces with corrosion/pitting on cartridge and component seals.	
	Practice of reusing seal faces with corrosion/pitting on cartridge and component seals.	
Component	Practice of replacing rotary units with fretting corrosion visible on ID of faces	
	Practice of reusing rotary units with fretting corrosion (common on rotary faces that use teflon v rings) visible on ID of faces (Most common on stainless steel chrome oxide plated faces)	
	Practice of using OEM certified faces in repair/rebuild	
	Practice of not using OEM certified faces in repair/rebuild	
	One Piece Carbon Soft Face Material Under Compression	
	One Piece Carbon Soft Face Material Under Tension	
	Two Piece Carbon Soft Face Material Under Compression	
	Two Piece Carbon Soft Face Material Under Tension	
	Practice of replacing soft seal faces on cartridge and component seals.	
	Practice of reusing relapped soft seal faces on cartridge and component seals.	
	One Piece Ceramic Hard Face Material Under Compression	
	One Piece Ceramic Hard Face Material Under Tension	

FIG. 12F

	I/B Rotary Face Materials of Construction	Cartridge & Component	Two Piece Ceramic Hard Face Material Under Compression	
			Two Piece Ceramic Hard Face Material Under Tension	
			One Piece Plated TC Hard Face Material Under Compression	
			One Piece Plated TC Hard Face Material Under Tension	
			Two Piece Plated TC Hard Face Material Under Compression	
			Two Piece Plated TC Hard Face Material Under Tension	
			One Piece Nick. Bonded TC Hard Face Material Under Compression	
			One Piece Nick. Bonded TC Hard Face Material Under Tension	
			Two Piece Nick. Bonded TC Hard Face Material Under Compression	
			Two Piece Nick. Bonded TC Hard Face Material Under Tension	
			One Piece Rxn Bond SC Hard Face Material Under Compression	
			One Piece Rxn Bond SC Hard Face Material Under Tension	
			Two Piece Rxn Bond SC Hard Face Material Under Compression	
			Two Piece Rxn Bond SC Hard Face Material Under Tension	
			One Piece Alpha SC Hard Face Material Under Compression	
			One Piece Alpha SC Hard Face Material Under Tension	Yes
			Two Piece Alpha SC Hard Face Material Under Compression	
			Two Piece Alpha SC Hard Face Material Under Tension	
			One Piece Chrome Oxide Hard Face Material Under Compression	
			One Piece Chrome Oxide Hard Face Material Under Tension	
			Two Piece Chrome Oxide Hard Face Material Under Compression	
			Two Piece Chrome Oxide Hard Face Material Under Tension	
			Practice of replacing hard seal faces on cartridge and component seals.	
			Practice of reusing relapped hard seal faces on cartridge and component seals.	
			Practice of replacing seal faces with corrosion/pitting on cartridg and component seals.	
			Practice of reusing seal faces with corrosion/pitting on cartridge and component seals.	

FIG. 12G

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Faces		Component	Practice of replacing rotary units with fretting corrosion visible on ID of faces	
			Practice of reusing rotary units with fretting corrosion (common on rotary faces that use teflon v rings) visible on ID of faces (Most common on stainless steel chrome oxide plated faces)	
	I/B Faces In Combination	Cartridge & Component	Soft Face Combination Carbon/Carbon	
			Soft Face Combination Carbon/Ceramic	
			Soft Face Combination Carbon/Plated TC	
			Soft Face Combination Carbon/Nick. Bonded TC	
			Soft Face Combination Carbon/Rxn Bond SC	
			Soft Face Combination Carbon/Alpha SC	
			Soft Face Combination Carbon/Chrome Oxide	
		Cartridge & Component	Hard Face Combination SC/SC	
			Hard Face Combination SC/TC	
			Hard Face Combination TC/TC	
			Hard Face Combination Cer/Cer	
			Practice of using OEM certified faces in repair/rebuild	
			Practice of not using OEM certified faces in repair/rebuild	
			One Piece Carbon Soft Face Material Under Compression	
			One Piece Carbon Soft Face Material Under Tension	
			Two Piece Carbon Soft Face Material Under Compression	
			Two Piece Carbon Soft Face Material Under Tension	
			Practice of replacing soft seal faces on cartridge and component seals.	
			Practice of reusing relapped soft seal faces on cartridge and component seals.	
			One Piece Ceramic Hard Face Material Under Compression	
			One Piece Ceramic Hard Face Material Under Tension	
			Two Piece Ceramic Hard Face Material Under Compression	
			Two Piece Ceramic Hard Face Material Under Tension	
			One Piece Plated TC Hard Face Material Under Compression	
			One Piece Plated TC Hard Face Material Under Tension	
			Two Piece Plated TC Hard Face Material Under Compression	
			Two Piece Plated TC Hard Face Material Under Tension	
			One Piece Nick. Bonded TC Hard Face Material Under Compression	
			One Piece Nick. Bonded TC Hard Face Material Under Tension	

FIG. 12H

	O/B Stationary Face Materials of Construction	Cartridge & Component	Two Piece Nick. Bonded TC Hard Face Material Under Compression	
			Two Piece Nick. Bonded TC Hard Face Material Under Tension	
			One Piece Rxn Bond SC Hard Face Material Under Compression	
			One Piece Rxn Bond SC Hard Face Material Under Tension	
			Two Piece Rxn Bond SC Hard Face Material Under Compression	
			Two Piece Rxn Bond SC Hard Face Material Under Tension	
			One Piece Alpha SC Hard Face Material Under Compression	
			One Piece Alpha SC Hard Face Material Under Tension	
			Two Piece Alpha SC Hard Face Material Under Compression	
			Two Piece Alpha SC Hard Face Material Under Tension	
			One Piece Chrome Oxide Hard Face Material Under Compression	
			One Piece Chrome Oxide Hard Face Material Under Tension	
			Two Piece Chrome Oxide Hard Face Material Under Compression	
			Two Piece Chrome Oxide Hard Face Material Under Tension	
			Practice of replacing hard seal faces on cartridge and component seals.	
			Practice of reusing relapped hard seal faces on cartridge and component seals.	
			Practice of replacing seal faces with corrosion/pitting on cartridge and component seals.	
			Practice of reusing seal faces with corrosion/pitting on cartridge and component seals.	
		Component	Practice of replacing rotary units with fretting corrosion visible on ID of faces	
			Practice of reusing rotary units with fretting corrosion (common on rotary faces that use teflon v rings) visible on ID of faces (Most common on stainless steel chrome oxide plated faces)	
			Practice of using OEM certified faces in repair/rebuild	
			Practice of not using OEM certified faces in repair/rebuild	
			One Piece Carbon Soft Face Material Under Compression	
			One Piece Carbon Soft Face Material Under Tension	

FIG. 12I

	O/B Rotary Face Materials of Construction	Cartridge & Component	Two Piece Carbon Soft Face Material Under Compression	
			Two Piece Carbon Soft Face Material Under Tension	
			Practice of replacing soft seal faces on cartridge and component seals.	
			Practice of reusing relapped soft seal faces on cartridge and component seals.	
			One Piece Ceramic Hard Face Material Under Compression	
			One Piece Ceramic Hard Face Material Under Tension	
			Two Piece Ceramic Hard Face Material Under Compression	
			Two Piece Ceramic Hard Face Material Under Tension	
			One Piece Plated TC Hard Face Material Under Compression	
			One Piece Plated TC Hard Face Material Under Tension	
			Two Piece Plated TC Hard Face Material Under Compression	
			Two Piece Plated TC Hard Face Material Under Tension	
			One Piece Nick. Bonded TC Hard Face Material Under Compression	
			One Piece Nick. Bonded TC Hard Face Material Under Tension	
			Two Piece Nick. Bonded TC Hard Face Material Under Compression	
			Two Piece Nick. Bonded TC Hard Face Material Under Tension	
			One Piece Rxn Bond SC Hard Face Material Under Compression	
			One Piece Rxn Bond SC Hard Face Material Under Tension	
			Two Piece Rxn Bond SC Hard Face Material Under Compression	
			Two Piece Rxn Bond SC Hard Face Material Under Tension	
			One Piece Alpha SC Hard Face Material Under Compression	
			One Piece Alpha SC Hard Face Material Under Tension	
			Two Piece Alpha SC Hard Face Material Under Compression	
			Two Piece Alpha SC Hard Face Material Under Tension	
			One Piece Chrome Oxide Hard Face Material Under Compression	
			One Piece Chrome Oxide Hard Face Material Under Tension	
			Two Piece Chrome Oxide Hard Face Material Under Compression	

FIG. 12J

			Two Piece Chrome Oxide Hard Face Material Under Tension	
			Practice of replacing hard seal faces on cartridge and component seals.	
			Practice of reusing relapped hard seal faces on cartridge and component seals.	
			Practice of replacing seal faces with corrosion/pitting on cartridge and component seals.	
			Practice of reusing seal faces with corrosion/pitting on cartridge and component seals.	
		Component	Practice of replacing rotary units with fretting corrosion visible on ID of faces	
			Practice of reusing rotary units with fretting corrosion (common on rotary faces that use teflon v rings) visible on ID of faces (Most common on stainless steel chrome oxide plated faces)	
	O/B Faces In Combination	Cartridge & Component	Soft Face Combination Carbon/Carbon	
			Soft Face Combination Carbon/Ceramic	
			Soft Face Combination Carbon/Plated TC	
			Soft Face Combination Carbon/Nick. Bonded TC	
			Soft Face Combination Carbon/Rxn Bond SC	
			Soft Face Combination Carbon/Alpha SC	
			Soft Face Combination Carbon/Chrome Oxide	
			Hard Face Combination SC/SC	
			Hard Face Combination SC/TC	
			Hard Face Combination TC/TC	
			Hard Face Combination Cer/Cer	
Elastomers	I/B Design	Cartridge & Component	O-ring Elastomer Type	
			Teflon V-Ring Elastomer Type	Yes
			Teflon Wedge-Ring Elastomer Type	
			Teflon U-Cup Elastomer Type	
	I/B Materials of Construction	Cartridge & Component	Viton Elastomer Material	
			EPR Elastomer Material	
			Teflon Elastomer Material	
			Aflas Elastomer Material	
			Kalrez Elastomer Material	
			Chemraz Elastomer Material	
			Graphoil Elastomer Material	
	O/B Design	Cartridge & Component	O-ring Elastomer Type	
			Teflon V-Ring Elastomer Type	
			Teflon Wedge-Ring Elastomer Type	
			Teflon U-Cup Elastomer Type	
	O/B Materials of	Cartridge & Comp	Viton Elastomer Material	
			EPR Elastomer Material	
			Teflon Elastomer Material	
			Aflas Elastomer Material	

FIG. 12K

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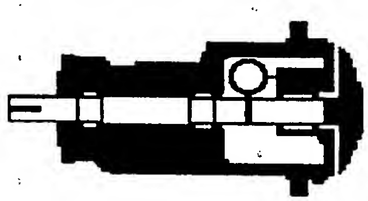
	Construction	Component	Kalrez Elastomer Material	
			Chemraz Elastomer Material	
			Graphoil Elastomer Material	
	Repair & Rebuilding Procedures	Cartridge & Component	Practice of using OEM certified elastomers in repair/rebuild	
			Practice of not using OEM certified elastomers in repair/rebuild	
			Practice of replacing elastomers	
			Practice of reusing elastomers	
Face Energizing Mechanism	Design	Cartridge & Component	Spring Type (Wave Spring)	
			Spring Type (Single Coil)	
			Spring Type (Multiple Coil)	Yes
			Metal Bellows Design	
			Out of Fluid Design	
			Immersed in process fluid Design	Yes
	Materials of construction	Cartridge & Component	316SS Metallurgy	
			Alloy 20 Metallurgy	
			Hastelloy C Metallurgy	
			Titanium Metallurgy	
	Repair & Rebuilding Procedures	Cartridge & Component	Practice of using OEM certified springs in repair/rebuild	
			Practice of not using OEM certified springs in repair/rebuild	
			Practice of using OEM certified metal bellows in repair/rebuild	
			Practice of not using OEM certified metal bellows in repair/rebuild	
			Practice of replacing springs	
			Practice of reusing springs	
			Practice of replacing metal bellows	
			Practice of reusing metal bellows	
Gaskets	Repair & Rebuilding Procedures	Cartridge & Component	Practice of using OEM certified gaskets in repair/rebuild	
			Practice of not using OEM certified gaskets in repair/rebuild	
			Practice of replacing gaskets	
			Practice of reusing gaskets	
Seal Settings			Stuffing Box Face Perpendicularity 	.003"

FIG. 12L

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		Process Fluid
		Acetone; Tem <210 F (1302)
		System Recommendations
	Product Temperature	150 F
	Product Crystalizes	Yes
	Product Polymerizes	Yes
	Product is Thermal Sensitive	No
	Specific Gravity	1.1
	Vapor Pressure	45 PSIA
	Viscosity	15000 SSU
	Concentration	75%
	% Dissolved Solids	1%
	% Undissolved Non-Fibrous Solids	0.50%
	% Undissolved Fibrous Solids	2%

1304

FIG. 13

1400	MTBF (Mean Time Between Failure) for seals in years	
1402	# of days/year plant operates	
1404	# of hours/day plant operates	
1406	Kilowatts/hours for Avg. balanced seal	
	Additional power required for unbalanced seal	
1408	Average # of repacks per year	
	Average # of adjustments per year per box	
	Average Life of Shaft/Sleeve (in years) Before Replacement Is Required Due To Packing & Bearing Failure Damage	
	Avg. Seal Water (in gpm) Flush Entering Each Packed Stuffing Box , Entering the process stream	
	Average Seal Water Flush (in gpm) required for a single mechanical seal entering the process stream.	
	The Reduction in Seal Water Usage Per Stuffing Box By The Use Of Mechanical Seals	
	Change In Temp. Difference Between System Temp. and Seal Water Flush Temp. (Ex. 85 Deg.F. system temp. , 65Deg.F. Seal Water Temp = 20 Deg.F.)	
	Avg. Requirement For A Packed Pump is 2KW Per Hour. Avg. For A Balanced Mechanical Seal Is .33KW Per Hour (The Excess Power Required Per Pump Is 1.67 KW/Hour) Based on 2.000 " seal, adjust up or down by average shaft/ sleeve size in plant	
	Avg. Leakage of Each Stuffing Box in Drops/Min	
	# of Machines With Unscheduled Downtime	
	% of Equip. Requiring Unscheduled Repairs As a Result of Excess Leakage (Ex. Bearing failure due to product leakage contamination)	
	Frequency of shaft /sleeve replacement	
	% of Component Seals In Which Installation Is Not Correct The First Time	
	Increased MTBF provided by superior seal design. Average Decrease In Seal Life For The Entire Plant Seal Population Due To Existing Design Deficiencies	

FIG. 14A

09/643, 576

Overall Plant Information	Increased MTBF provided by ESP software technologies assuring that the correct seals with correct materials of construction and environmental controls with engineering documentation provides unsurpassed plant efficiencies.	
	Increased MTBF provided plant reliability software which enables identification of problems preventing reinstallation of those problems.	
	Overall Decrease in Seal Life Due To Premature Failure. (Over compressed & Under compressed component and erroneous installations)	
Labor Information	Additional Hours Req'd For Installation vs. Cartridge Design	
	Additional Hours Req'd For Component vs. Cartridge Design	
	Average Installation Time For A Component Seal	
	Hours Required For Disassembly & Reinstallation of Seal	
	Average # of Manhours Per Repack	
	Average # of Manhours Per Adjustment	
	Average # of Manhours Per Replacement	
	# of Hours Machinery Is Down Per Year Due to Eqpt Failure Attributed to Product Leakage	
	# of Housekeeping / Hours Per Year Per Pump (Cleaning Leakage)	
	# of Hours To Install One Mechanical Seal	

FIG. 14B

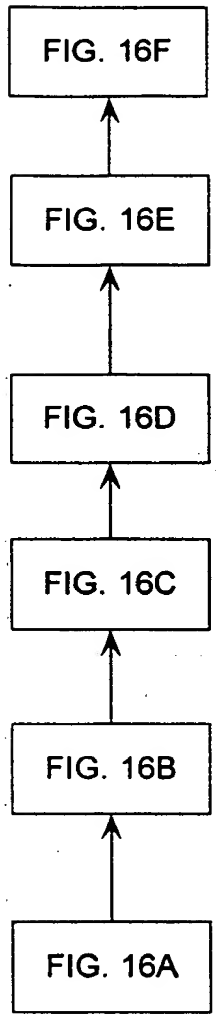

FIG. 15

09/643,576

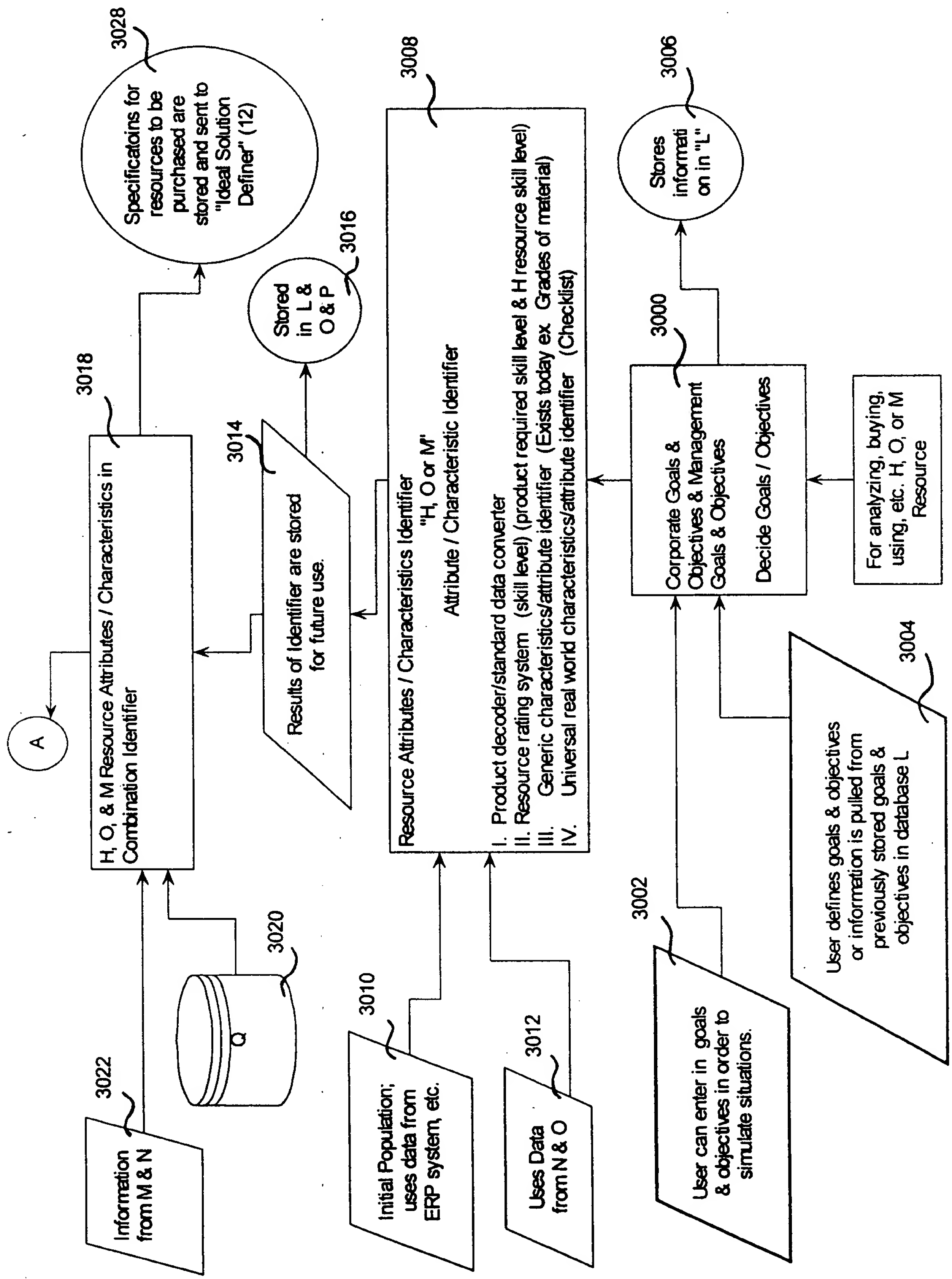

FIG. 16A

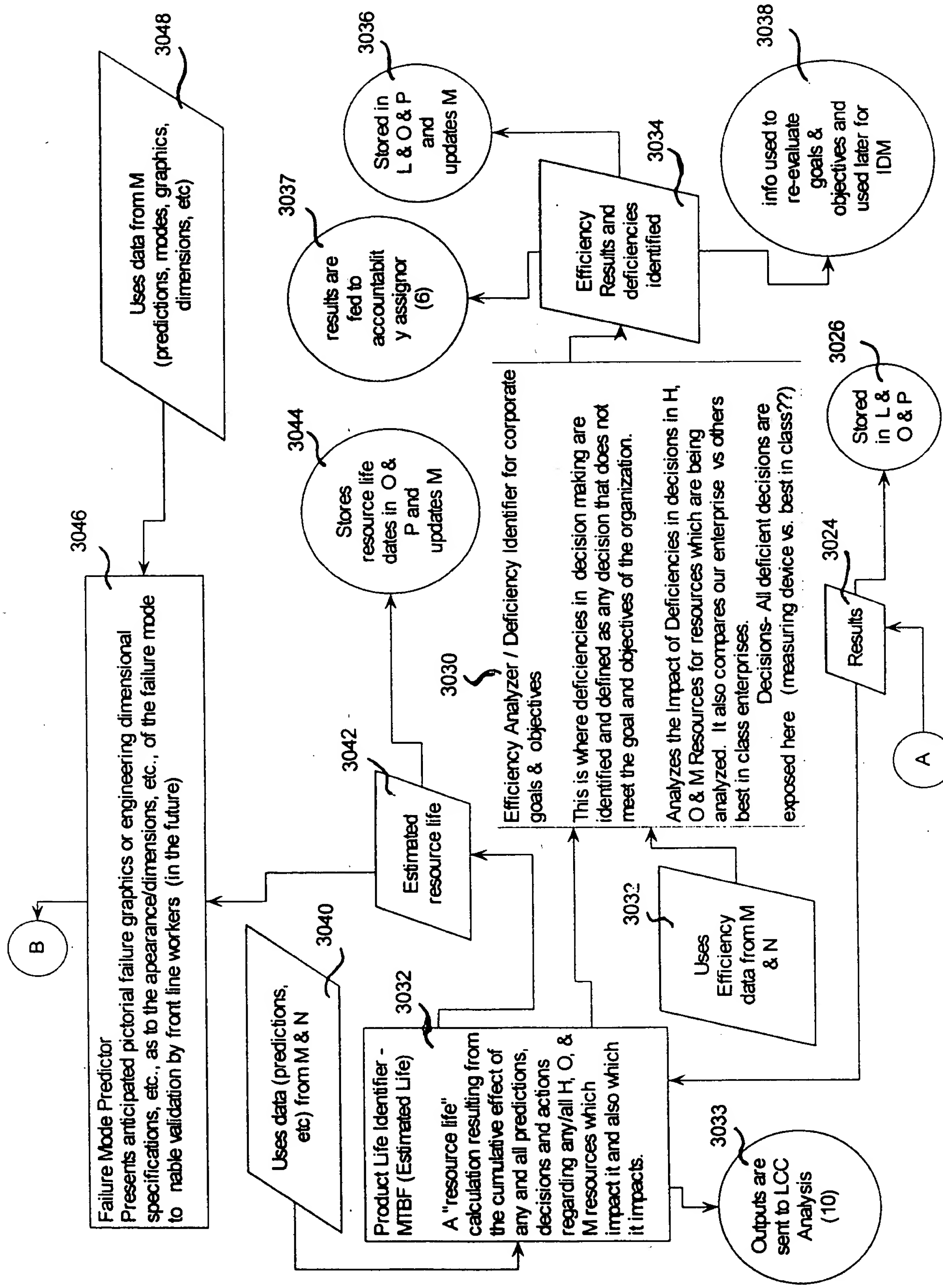
Failure Mode Predictor
Presents anticipated pictorial failure graphics or engineering dimensional specifications, etc., as to the apearance/dimensions, etc., of the failure mode to nable validation by front line workers (in the future)
3046
Uses data from M (predictions, modes, graphics, dimensions, etc)
3048
B
Uses data (predictions, etc) from M & N
3040
Product Life Identifier - MTBF (Estimated Life)
A "resource life" calculation resulting from the cumulative effect of any and all predictions, decisions and actions regarding any/all H, O, & M resources which impact it and also which it impacts.
3032
Outputs are sent to LCC Analysis (10)
3033
Estimated resource life
3042
Stores resource life dates in O & P and updates M
3044
Uses Efficiency data from M & N
3032
Efficiency Analyzer / Deficiency Identifier for corporate goals & objectives
3030
This is where deficiencies in decision making are identified and defined as any decision that does not meet the goal and objectives of the organization.
Analyzes the Impact of Deficiencies in decisions in H, O & M Resources for resources which are being analyzed. It also compares our enterprise vs others best in class enterprises.
Decisions- All deficient decisions are exposed here (measuring device vs. best in class??)
results are fed to accountability assignor (6)
3037
Efficiency Results and deficiencies identified
3034
Stored in L & O & P and updates M
3036
info used to re-evaluate goals & objectives and used later for IDM
3038
Results
3024
Stored in L & O & P
3026
A

FIG. 16B

09/683,516

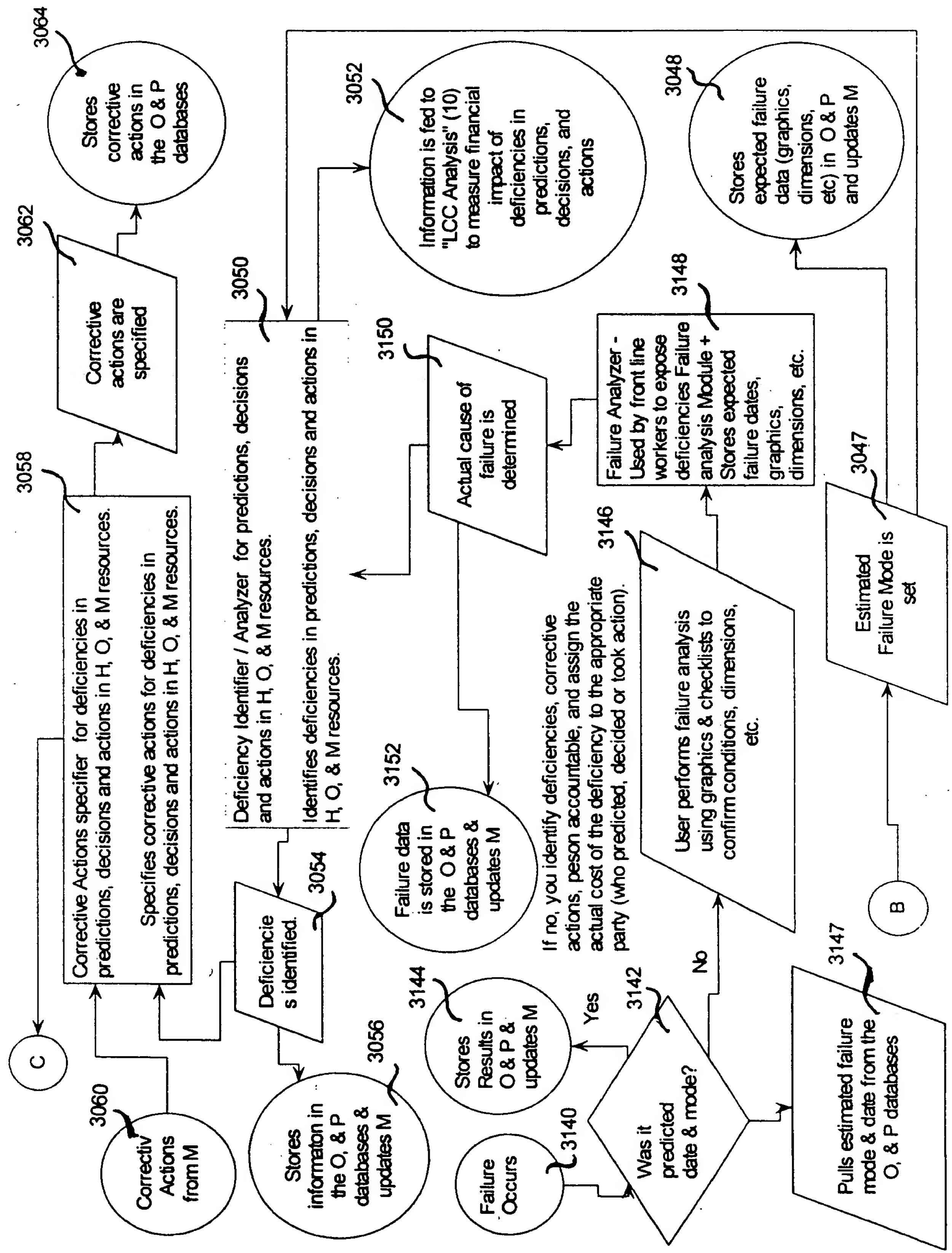

FIG. 16C

09/643,576

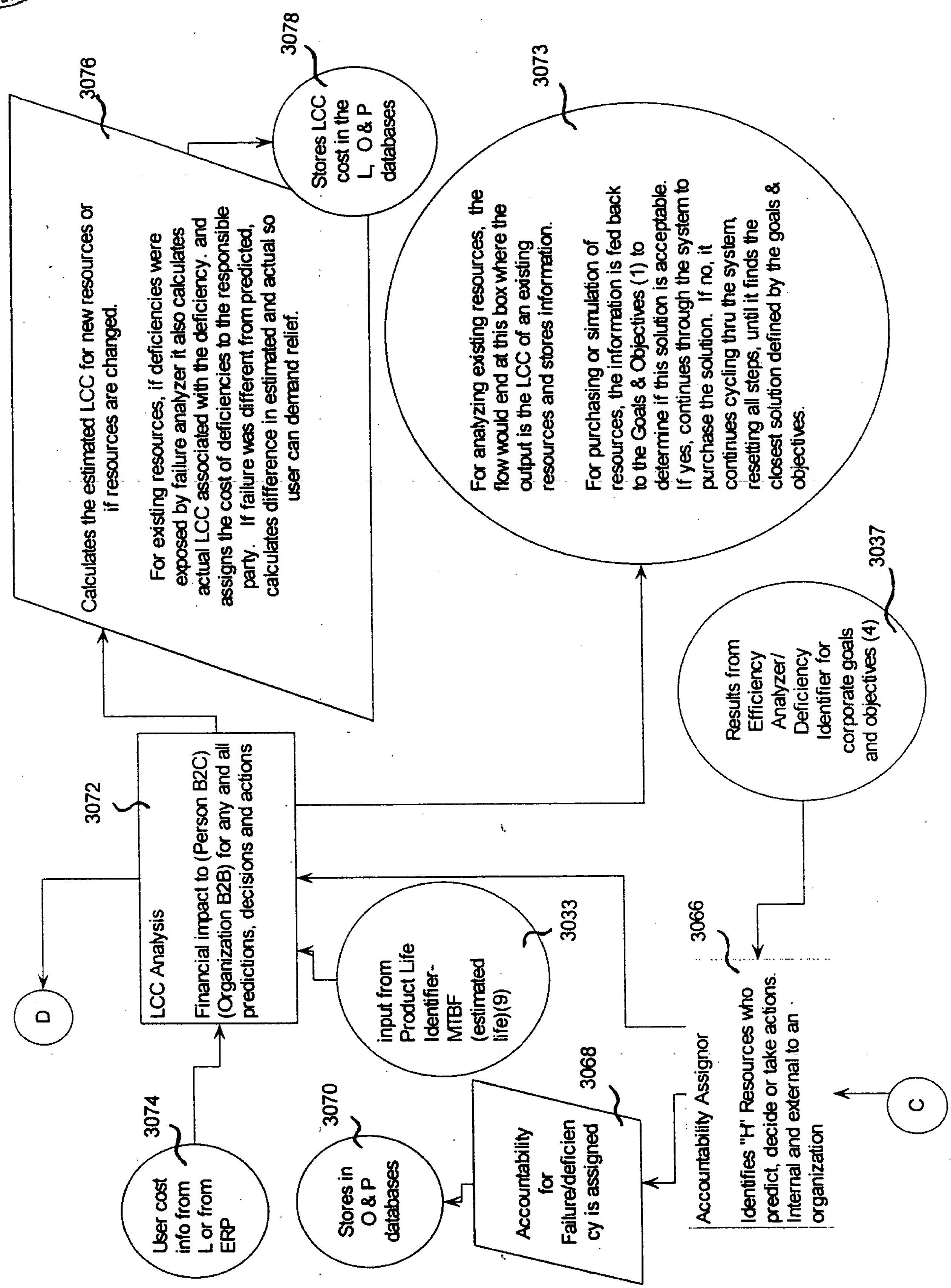

FIG. 16D

09/693,576

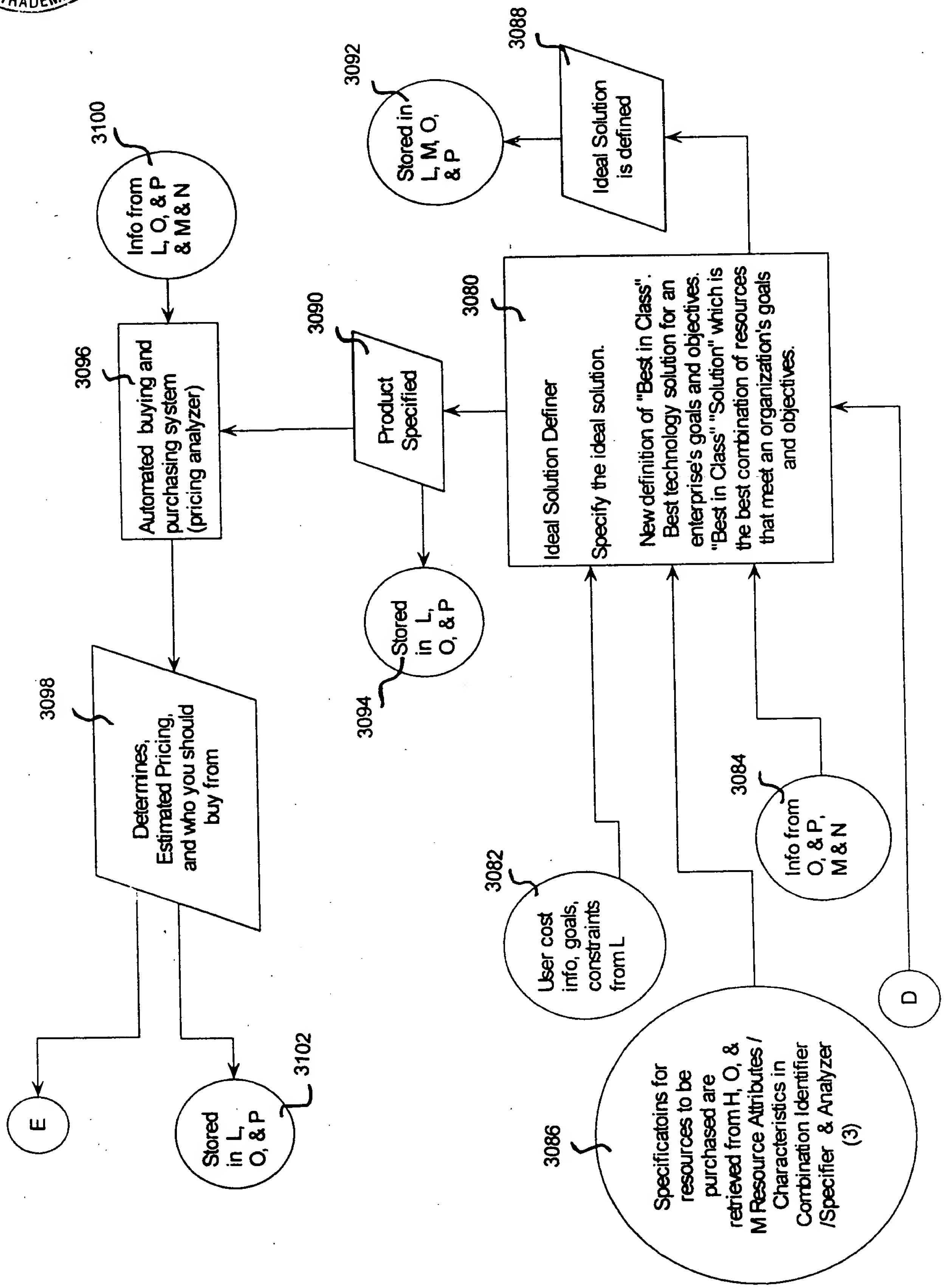

FIG. 16E

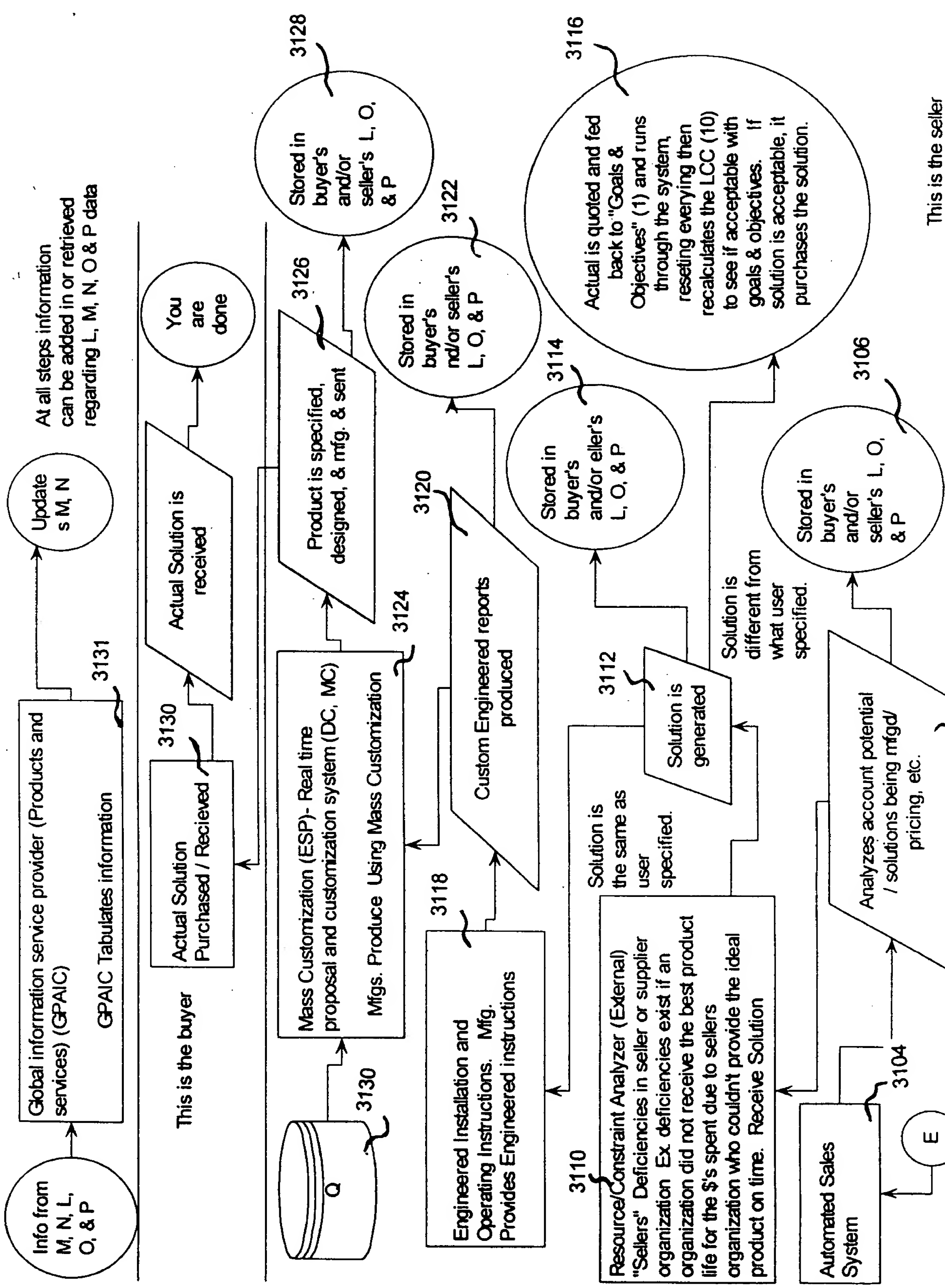
Info from M, N, L, O, & P
Global information service provider (Products and services) (GPAIC)
GPAIC Tabulates information
3131
Update s M, N
At all steps information can be added in or retrieved regarding L, M, N, O & P data
This is the buyer
Actual Solution Purchased / Recieved
3130
Actual Solution is received
You are done
Q
3130
Mass Customization (ESP)- Real time proposal and customization system (DC, MC)
Mfgs. Produce Using Mass Customization
3124
Product is specified, designed, & mfg. & sent
3126
Stored in buyer's and/or seller's L, O, & P
3128
Engineered Installation and Operating Instructions. Mfg. Provides Engineered instructions
3118
Custom Engineered reports produced
3120
Stored in buyer's nd/or seller's L, O, & P
3122
Resource/Constraint Analyzer (External) "Sellers" Deficiencies in seller or supplier organization Ex. deficiencies exist if an organization did not receive the best product life for the $'s spent due to sellers organization who couldn't provide the ideal product on time. Receive Solution
3110
Solution is the same as user specified.
Solution is generated
3112
Stored in buyer's and/or eller's L, O, & P
3114
Solution is different from what user specified.
Actual is quoted and fed back to "Goals & Objectives" (1) and runs through the system, reseting everying then recalculates the LCC (10) to see if acceptable with goals & objectives. If solution is acceptable, it purchases the solution.
3116
E
Automated Sales System
3104
Analyzes account potential / solutions being mfgd/ pricing, etc.
3108
Stored in buyer's and/or seller's L, O, & P
3106
This is the seller

FIG. 16F

09/643,576

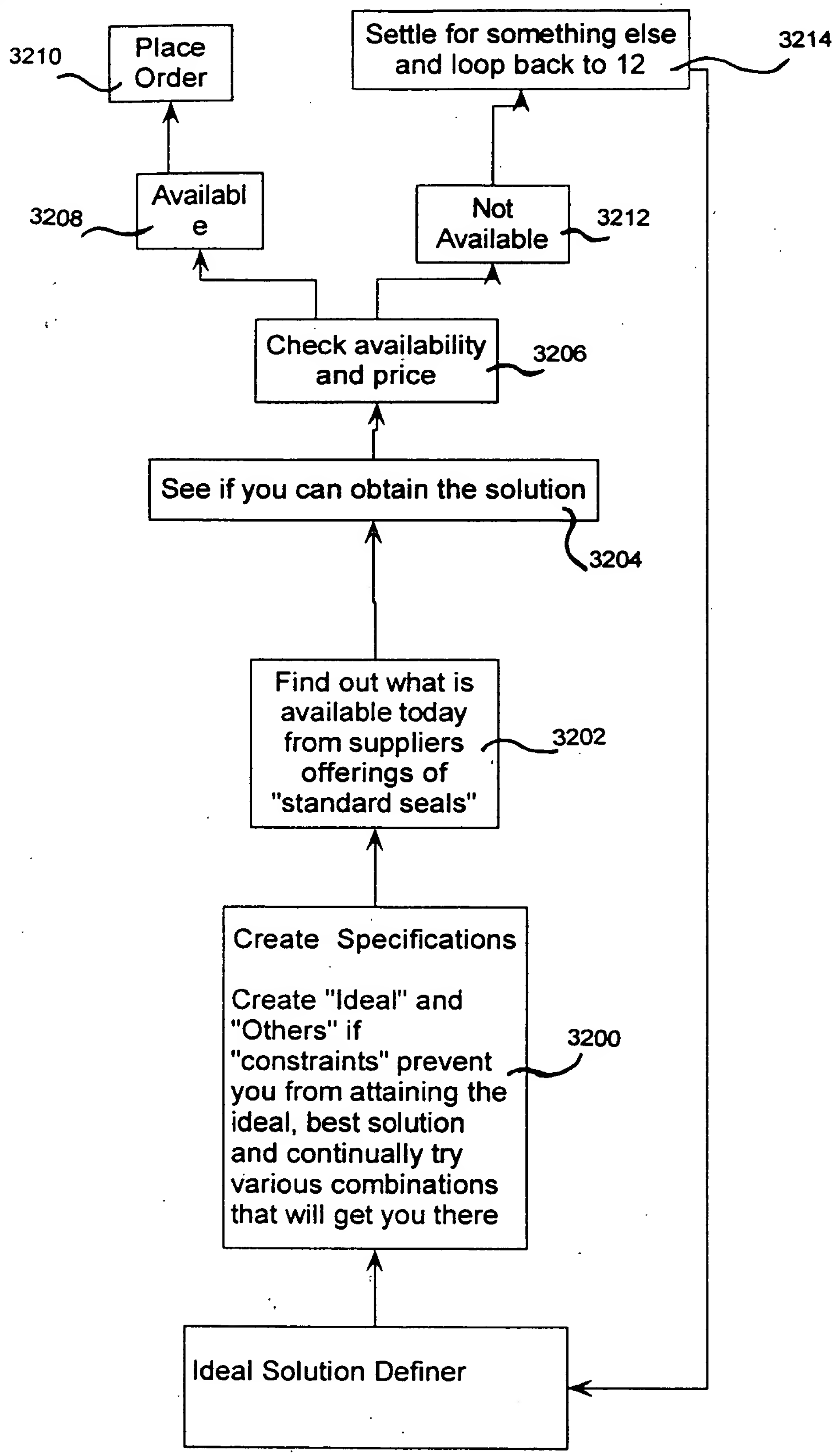

FIG. 17

09/643,376

1	Each test is performed under controlled laboratory conditions with pre-selected expert individuals. Estimated life of each in a controlled environment on test stands	Raw Material Mfgs Perform Laboratory Tests	1800 Mfg. of Component			Face Suppliers			O-ring Suppliers			Gland Suppliers	Gasket Suppliers	Spring Suppliers
			Material			Material PG523	Material PG792	Material PG957	Grade A	Grade B	Grade C	Etc.	Etc.	Etc.
			Estimated Life			Estimated life 5 years	Estimated life 15 years	Estimated life 35 years	Estimated life 1 year	Estimated life 5 years	Estimated life 10 years	12 years	8 years	20 years

1802 1808 1810

2	Each test is performed under controlled laboratory conditions with pre-selected expert individuals. Estimated life of each in a controlled environment Ex. Water and 6% oil solution, 70 degrees, dust fee room, etc., etc.,	Component Mfgs Perform Laboratory Tests	Mfg. of Subassembly	Bearing Mfgs		Bearing Protection Mfgs	Seal Mfgs	Shaft Mfgs	Impeller Mfgs	Human
			Design	Option 1 CB Design with lube filter system	Option 2 DL Design	Double lip seal design made of Viton with x durometer,	Balanced design 75/20 with face width of 100 with multi coil springs, etc.	Shaft with L3/D4 of 3 made of 316SS with bearing tolerance of .005	Open impeller design	Scientists / experts assemble in clean room environment, etc. etc.
			Estimated Life	Estimated life 30 years	Estimated life 15 years	Estimated life 6 years	Estimated life 5 years	Estimated life 50 years	Estimated life 6 years	

1812

FIG. 18A

1804

3	Tests all pieces in combination in controlled environment	Equipment Mfgs Perform Laboratory Tests	Mfg. of Assembly	Pump Mfgs Very limited controlled environment testing. Controlled laboratory conditions of 70 degrees, same trained expert installs all components, etc.							
			Design	Bearing Housing Fits .0025	Bearing Housing Fits .010	Frame Adapter Fits < .005	Frame Adapter Fits .005-.015	Rigidity of Shaft based on overhang	Design with axial shaft play < .006	Design with axial shaft play .006-.010	Seal mfg Life from above
			Estimated Life for each item	10 years	3 years	15 years	5 years		10 years	5 years	5 years
			Assembly Estimated Life	Estimated life could have been 12 years but now it is 3 years due to less than best in class offerings							
4	Invention combines scientists findings with field findings of "H", "O", & "M" resources in combination and enables predicted outcomes	Users perform Real World testing	User of Assembly	End User Plants (Real World)							
			Design	Installation of Pump with H skill level of 1	Installation of pump with H skill level of 10	Equipment Condition Shaft Run out < .004	Equipment Condition Shaft Run out .005-.010				
			Estimated Life for each item	195 days	1095 days	1000 days	700 days				
			Assembly Estimated Life	Estimated life could have been 3 years but now it is 195 days due to less than best in class offerings							

1814

1806

FIG. 18B